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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
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| 10/660,348 | 09/11/2003 | Zhifeng Ren | 94505-011101/US | 5141 |

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| EXAMINER |
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MILLER, DANIEL H

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| ART UNIT | PAPER NUMBER |
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1775

DATE MAILED: 12/04/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

| | | | |
|------------------------------|-------------------------------|----------------------------|--|
| Office Action Summary | Application No. 10/660,348 | Applicant(s) REN ET AL. | |
| | Examiner Daniel Miller | Art Unit 1775 | |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 9/5/2006.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-24 and 55-84 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-6, 8-24 and 55-84 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Rejections - 35 USC § 112

1. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

2. All pending Claims are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. There is no clear support for the newly claimed range of "at least three" nanostructures in the specification to the exclusion of two nanostructures. Please provide specific support for the newly claimed range of "at least three".

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the

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invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 1-5, 9-10, 12, 15-16, 19-23, **55-57**, 60 and 64-67, **68-70**, 72-75, 77, 79, 80 and 8, 13-14, 17-18, 61, 63, 76, 78, 80-84 are rejected under 35 U.S.C. 103(a) as being unpatentable over Majumdar (US 6,996,147).
3. Regarding independent claims 1, 55, and 68, Manjumdar teaches a nanowire with at least two crystalline materials of different composition creating heterostructures (abstract). The crystalline structures can be oxides such as ZnO or CdO (column 31 line 53-68). The structure forms arrays having a structure as depicted in figures 34-35. The figures depict a central spine (nanowire) with terminally attached linear nanostructure rods that are oriented non-parallel; as required in claim 1. The reference does not specifically teach at least three second metallic oxides. It does teach alternating oxide layers (figure 25 and 34) that yield a nanowire comprises compositionally different material (column 9 line 30-37). It would have been obvious to one of ordinary skill in the art to attach at least three metal oxides or nanostructures to the central nanostructure because Manjumdar teaches creating multi-terminal devices ($N > 2$; column 26 line 55-65) for various electrical applications.
4. Regarding claim 55, there are a plurality of nanostructures and it would also be obvious to have at least three nanostructures attached to the central nanostructure (see figure 35). Regarding claim 68, the first metal oxide has attached to its end a second metal oxide (figure 35). It would be obvious to have at least three oxides attached between the ends of the first nanostructure to create multi-terminal devices.

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5. Regarding claims 2 and 10, the wire has a predetermined 2 fold symmetry (figure 34-35).
6. Regarding claims 3-4, 9 and 12, 56, 69, the nanowire can be entirely ZnO.
7. Regarding claim 5 and 23, 57, 70, the nanowire heterostructure can have a dopant (abstract).
8. Regarding claims 15-16 and 19-20, 62, 64, 77, and 79 the diameter of the nanowire is less than 200 nm (see reference claim 1).
9. Regarding claims 21-22, 65, 73, figure 34 depicts an embodiment where the crystal off shoot is orthogonal to the spine main nanowire while figure 35 depicts an embodiment that is non-orthogonal off-shoot from the spine nanowire.
10. Regarding claims 66-67, 74 and 75, the device can be used to make a microelectronic device, specifically a blue optic device (column 31 line 55-61).
11. Finally, with regards to claims reciting a particular morphology (e.g. claim 4), the crystal structure is a nanowire (abstract).
12. Regarding claim 8, the reference depicts many embodiments of nanostructured nanorods that can comprise any number of segments (column 2 line 17-22, figures 1-36) some of which would have three distinct oxide compositions (figure 11), or would render the use of three different oxides obvious.
13. Regarding claims 13-14, 17-18, 61, 63, 76, 78, it would be obvious to optimize the nanostructure lengths in order to use the structure as an electrical wiring or in an optical device (see claims); optimizing a known variable through routine experimentation is obvious.

14. Regarding claim 80-84, there are a plurality of metal oxides depicted in figure 35 with three separate branches containing a first and second metal oxide although the figure depicted is silent as to the presence of a network of connected pieces. It would have been obvious to connect a network of nanowires in a variety of configurations in order to create an electrical circuit because there is a need for a broad spectrum of high performance energy conversion devices using nanowires (column 1 line 56-63).

15. Claims 6, 58, and 71 are rejected under 35 U.S.C. 103(a) as being unpatentable over Majundar in view of Yang (US 2004/0131537).

16. Mujundar, discussed above, teaches there is a need to create a broad spectrum of high performance energy conversion devices using nanowires (column 1 line 56-63), but is silent as to the nanorods being doped with Tin.

17. Yang teaches a nanoribbon used as an actuator that is doped with Tin (abstract).

18. It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Majundar and dope it with Tin in order to get similar modifications of p-type oxides in a broad spectrum of high performance energy conversion devices using nanowires.

19. Claims 6, 11 and 58-59 and 71 are rejected under 35 U.S.C. 103(a) as being unpatentable over Majundar in view of Wang (U.S. 6,586,095).

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20. Mujundar, discussed above, teaches an optical device but is silent as to the nanorods being formed from Indium Oxide.

21. Wang teaches a Tin-doped oxide nanostructure where the nanostructured oxide is Indium oxide (ITO) are used as films for flat panel displays (column 1 line 18-28).

22. It would have been obvious to a person of ordinary skill in the art to modify the (ITO) material in for use of the optical device of Mujundar in a display device.

Response to Arguments

23. Applicant's arguments with respect to all pending claims have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Daniel Miller whose telephone number is (571)272-1534. The examiner can normally be reached on M-F.


If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jennifer McNeil can be reached on (571) 272-1540. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Daniel Miller



JENNIFER MCNEIL
SUPERVISORY PATENT EXAMINER
11/27/06